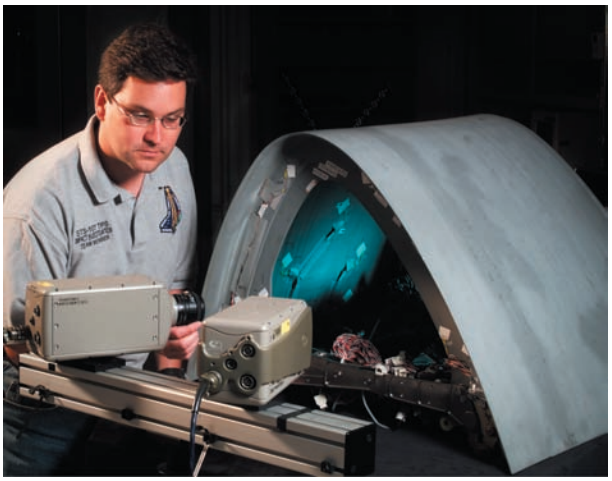
National Aeronautics and Space Administration
Glenn Research Center

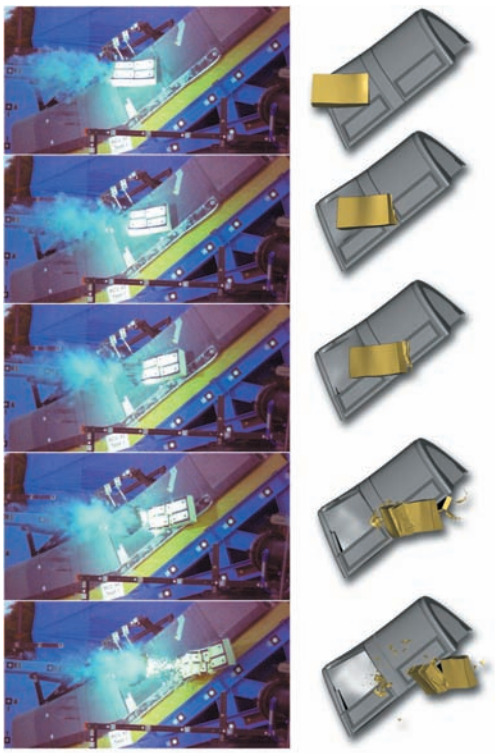
Return To Flight

Ballistic Impact Laboratory

Team Lead: Matthew Melis



An engineer in the Ballistics Impact Laboratory sets up the high-speed digital camera to aid in testing the orbiter leading edge.



High-speed digital images taken from the full-scale wing leading-edge tests.

Various thermal protection materials that are on the Shuttle's external tank and solid rocket boosters have the potential to shed from those components during launch and impact the orbiter or external tank. In addition, ice, which may form on the external tank, is considered a potential threat.

At NASA Glenn Research Center, (GRC) the Ballistic Impact Laboratory is involved in numerous critical path elements supporting NASA's Return to Flight effort. For the last year, an extensive spectrum of impact test programs has been utilizing the GRC Ballistic Impact Laboratory to assess the impact damage threat of various debris to the orbiter windows, external tank structure, and orbiter leading edges.

For each program, the components are subjected to hundreds of impacts from foam, ice, and thermal protection materials at different sizes, speeds, and impact angles. Shuttle program engineers are onsite to quantify the severity of the resulting damage, if any, after each test. Should a test series demonstrate that any component received unacceptable damage, a redesign or fix will be made to eliminate the debris threat to the shuttle. All of these test programs must be completed prior to NASA returning the shuttle fleet to flight.

In addition, GRC has been one of the key participants in an Agency-wide effort to develop an analysis capability to predict impact damage on orbiter leading edges due to foam, other thermal protection materials, and ice impacts. GRC's specific contributions have been the development of the material models for foam, ice, and reinforced carbon-carbon (orbiter leading-edge material) required for accurate analysis results. This work, also on the critical path for Return to Flight, has resulted in the development of a capability that did not exist at the time of the Columbia accident.

In addition, the GRC researchers in the Ballistics Impact Laboratory are providing onsite support for the orbiter leading-edge full-scale impact tests at Southwest Research Institute in San Antonio, Texas. These tests will help validate the results of the aforementioned analysis capability.